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EXAMINER	
PEREZ DAPLE, AARON C	
ART UNIT	PAPER NUMBER
2154	

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/934,059	GAIKWAD ET AL.	
	Examiner	Art Unit	
	Aaron C Perez-Daple	2154	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This Action is in response to Amendment filed 9/13/04, which has been fully considered.

2. Claims 1-27 are presented for examination.

3. This Action is FINAL.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 1-25** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, in claims 1 and 25 it is unclear whether the recited "process input control signal," which is claimed as provided by the controller, is separate from the "controller output signal" recited in the step of calculating. Under the reasoning presented below in the Response to Arguments section, the Examiner reasonably interprets that the claimed "controller output signal" and the claimed "process input control signal" both refer to the controller output 20 of Fig. 1.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. **Claims 1-12, 14-20 and 25-27** are rejected under 35 U.S.C. 102(b) as being anticipated by Nishikawa et al (Nishikawa et al., "A Method for Auto-Tuning of PID Control Parameters", Automatica, vol. 20, no. 3, pp. 321-332, 1984.) (hereinafter Nishikawa).

8. As for claims 1 and 25, Nishikawa discloses a method and a tuning device for determining one or more new gains for a controller while the controller continues to control a process towards a target loop transfer function (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967)."), the controller receiving a process output signal (x, Fig. 3) and a process set point signal (R, Fig. 3) and providing a process input control signal (Fig. 3), the method comprising the steps of:

introducing a disturbance into the process input control signal (pg. 323, "In contrast with these...desires to apply it.");

calculating one or more new gains for the controller using a controller output signal, the process input control signal, and the target loop transfer function (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here."); and

using the one or more new gains in the controller to subsequently control the process (Section 1, pgs. 321-322, "In the last few years...gives some concluding remarks.").

9. As for claim 2, Nishikawa discloses the method of claim 1, wherein the one or more new gains for the controller are determined without using a model of the process (Section 2, "A tuning procedure...have no interaction.").

10. As for claim 3, Nishikawa discloses the method of claim 1, wherein said gains include a proportional gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

11. As for claim 4, Nishikawa discloses the method of claim 1, wherein said gains include an integral gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

12. As for claim 5, Nishikawa discloses the method of claim 1, wherein said gains include a derivative gain (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

13. As for claim 6, Nishikawa discloses the method of claim 1, wherein the target loop transfer function is indicative of a desired response of the process (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967).").

14. As for claim 7, Nishikawa discloses the method of claim 6, wherein the target loop transfer function is a first-order transfer function (Section 2, "A tuning procedure...because the actions of P, I and D have no interaction.").

15. As for claim 8, Nishikawa discloses the method of claim 6, wherein the target loop transfer function is a second-order transfer function (Section 2, "A tuning procedure...because the actions of P, I and D have no interaction."; Section 4.2, "Let us examine...the control of real processes.")

16. As for claim 9, Nishikawa discloses the method of claim 1, wherein the process is controlled within a desired closed-loop control bandwidth (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

17. As for claim 10, Nishikawa discloses the method of claim 9, wherein the desired closed-loop control bandwidth is indicative of a desired settling time for the process (Fig. 4, Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

18. As for claim 11, Nishikawa discloses the method of claim 9, wherein the desired closed-loop control bandwidth is indicative of a time constant for the process (Fig. 4, Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here.").

19. As for claim 12, Nishikawa discloses the method of claim 1, wherein the disturbance includes one or more step changes (pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

20. As for claim 14, Nishikawa discloses the method of claim 1, wherein the disturbance includes a white noise signal that is band-pass filtered and clipped (N, Fig. 1).

21. As for claim 15, Nishikawa discloses the method of claim 1, wherein the disturbance is introduced into the controller output signal causing a response in the process input control signal (Fig. 3; pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

22. As for claim 16, Nishikawa discloses the method of claim 1, wherein the controller uses one or more new gains to produce the controller output signal (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

23. As for claim 17, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises a proportional error (pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

24. As for claim 18, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises an integral error (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

25. As for claim 19, Nishikawa discloses the method of claim 16, wherein the controller output signal comprises a derivative error (Table 4, pg. 327; Section 4.3, pgs. 326-328, "To overcome the...for the PID control.").

26. As for claim 20, Nishikawa discloses the method of claim 1, wherein the process input control signal is the sum of the controller output and the disturbance (Fig. 3; pg. 324, "Figure 3 shows a block diagram...of x(t) and y(t), respectively.").

27. As for claims 26 and 27, Nishikawa discloses a method and a tuning device for determining one or more new gains for a controller while the controller continues to control a process towards a target loop transfer function (Section 4.1, pgs. 325-326, "First, we summarize...without the derivate of J proposed by Zangwill (1967)."), the controller receiving a process output signal (x, Fig. 3) and a process set point signal (R, Fig. 3) and providing a controller output signal (y, Fig. 3), the method comprising the steps of:

introducing a disturbance into the controller output signal causing a response in a process input control signal (pg. 323, "In contrast with these...desires to apply it.");

calculating one or more new gains for the controller using the controller output signal, the response in the process input control signal, and the target loop transfer function (Section 3.2, pgs. 324-325, "The closed-loop procedure...is omitted here."); and

using the one or more new gains in the controller to subsequently control the process (Section 1, pgs. 321-322, "In the last few years...gives some concluding remarks.").

Claim Rejections - 35 USC § 103

28. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

29. **Claim 13** is rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Stoddard et al (US 5,895,596) (hereinafter Stoddard). Although obvious to one of ordinary skill in the art, Nishikawa does not specifically teach the use of a disturbance comprising a pseudo random binary sequence. However, Stoddard teaches the use of a disturbance comprising a pseudo random binary sequence (cols. 8-9, In a characterization control...implemented in statespace form.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by using a pseudo random binary sequence as the disturbance in order to allow for reliable identification of control parameters in a thermal reactor and for design simplicity, as taught by Stoddard (cols. 10-11, "The identification or characterization...outputs are measured.").

30. **Claims 13** is rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Grassi (E. Grassi, "Proportional-Integral-Derivative Controller Tuning by Frequency Loop-Shaping," Ph.D. dissertation, Arizona State University, December 1999.) (hereinafter Grassi).

Nishikawa does not specifically teach the use of a disturbance comprising a pseudo random binary sequence. However, Grassi teaches the use of a disturbance comprising a

pseudo random binary sequence (pgs. 29-30, "Good input signal...drift in the output occurs.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by using a pseudo random binary sequence as the disturbance in order to provide the excitation required to tune the controller parameters, as taught by Grassi (pgs. 29-30, "Good input signal...drift in the output occurs.").

31. **Claims 21-24** are rejected under 35 U.S.C. 103(a) as being obvious over Nishikawa in view of Grassi et al (Grassi et al, "PID Controller Tuning by Frequency Loop-Shaping," Proc. 35th Conference on Decision and Control, Japan, December 1996.) (hereinafter Grassi II).

32. As for claim 21, although Nishikawa teaches minimization of an error term that is arguably equivalent to Applicant's equation 6, Nishikawa does not specifically teach minimization of Applicant's equation 6. However, Grassi II teaches the minimization of an equivalent expression to Applicant's equation 6 (Section 2.3, "The tuning of the...with a suitable initialization.").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Nishikawa by minimizing an expression for the error between the desired closed loop response and actual closed loop response, such as Applicant's equation 6, in order to find an optimal tuning of the controller gains, as taught by Grassi II (Section 2.3, "The tuning of the...with a suitable initialization.").

33. As for claim 22, Nishikawa teaches a method similar to claim 21, wherein the sum total is minimized by curve fitting said sum total using recursive least squares technique with one or more constraints (Sections 4.1-4.3).

34. As for claim 23, Nishikawa teaches a method similar to claim 21, wherein the sum total is minimized by curve fitting said sum total using recursive least squares technique with one or more constraints (Sections 4.1-4.3).

35. As for claim 24, Nishikawa teaches a method similar to claim 23, wherein the recursive least squares technique constraint comprises positive values for the one or more new gains for the controller (Sections 4.1-4.3).

Response to Arguments

112 Claim Rejections

36. Applicant's arguments filed 9/13/04 have been fully considered but they are not persuasive.

Applicant asserts that the claims are clear as written because "the process control signal further includes introduced disturbance as set forth in the claim and illustrated in Fig. 1 and Fig. 2." The Examiner respectfully disagrees. The claims as constructed are still confusing and not internally consistent. Referring to Fig. 1, there is shown a single controller output signal 20, which is 1) fed into the PID gain tuner, and 2) added to a disturbance signal 24 to generate a control signal 26. It is important to note that control signal 26 is *not* output from the controller, but is rather output from the illustrated addition element as the sum of the controller output and the disturbance.

However, the claims are not consistent with the invention shown in Fig. 1. Specifically, the claims require that the *controller* provides the process input control signal. Furthermore, as claimed, the signal exists *prior* to introduction of the disturbance. Therefore, this signal cannot reasonably be interpreted as the same signal as control signal 26, shown in Fig. 1. In fact, only two signals are shown as output from the controller: 1) the controller output 20, and 2) the gain parameters 18. By Applicant's own admission and referring to Fig. 1, neither signal is fed directly into the process. In light of the above, the only reasonable interpretation is that the claimed *process input control signal* is the same as the controller output signal 20, since this is the only signal output from the controller and combined with a disturbance. Thus, the Examiner reasonably interprets that the claimed "controller output signal" and the claimed "process input control signal" both refer to controller output 20 of Fig. 1.

The Examiner notes that even if the 112, second paragraph, rejection were withdrawn, the claims would still be anticipated by the prior art for the same reasons cited with respect to claims 26 and 27.

For the above reasons, the rejection of claims 1-25 under 35 USC 112, second paragraph, is properly maintained.

102 Claim Rejections

37. Applicant's arguments filed 9/13/04 have been fully considered but they are not persuasive.

Applicant asserts that Nishikawa fails to teach or disclose using the disturbance to calculate the gain. First, the Examiner points out that this limitation is not actually claimed. Claims 1 and 25 actually recite "calculating one or more new gains using...the process input

control signal." As noted above in the 112 Claim Rejections section, the claims require that the process control input signal exists *prior* to the introduction of the disturbance. Therefore, claims 1 and 25 do not require using the disturbance to calculate the new gains.

Claims 26 and 27 actually recite "calculating one or more new gains for the controller using...the response in the process input control signal," wherein the response was caused by introducing a disturbance into the controller output signal. Applicant asserts that he can find no reference to this in Nishikawa. Apparently, Applicant failed to read the cited paragraph on page 323, which reads in part, "...the present procedure applies a kind of intentional disturbance to the process for estimating its parameters." The previous rejection mailed 6/9/04 further explicitly cited Fig. 3 of Nishikawa, which shows a disturbance signal N' introduced to the controller output signal y. It is clear from the discussion on page 323 of Nishikawa that this disturbance is used to calculate the gains. Detailed calculations are provided in sections 3.2 and 4. Again, the Examiner notes that the claims merely recite "using" the signals and do *not* limit how they used. The claims further do *not* require providing all of the signals to a second device, such as the gain tuner illustrated in Fig. 1.

For all these reasons, claims 1-12, 14-20 and 25-27 are properly rejected under 35 USC 102(b) as anticipated by Nishikawa.

103 Claim Rejections

38. Claims 13 and 21-24 are properly rejected under 35 USC 103(a) for the same reasons cited above with respect to claim 1.

Conclusion

39. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron C Perez-Daple whose telephone number is (571) 272-3974. The examiner can normally be reached on 9am-5pm.

40. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Follansbee can be reached on (571) 272-3964. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access

to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

2/3/05

Aaron Perez-Daple

John Follansbee